Agenda Item: 5.3

Source: Nokia

Title: On MBMS Notifications

Document for: Discussion & Decision

1   INTRODUCTION

In the RAN WG2 meeting #32 was agreed that MBMS notification shall be send in such a manner that UE can received it in IDLE and in RRC connected mode, moreover, the notification should be such that UE is able to minimise the power consumption, i.e. UE is able to use DRX.

Moreover, it was agreed that the reception of the notification is not guaranteed. However, the probability to receive MBMS notification should be high, meaning that some kind of repetition scheme is required for the case that some UEs receive first notification incorrectly.

Moreover, the UE coming to the cell from a cell inside MBMS service area or outside MBMS service are during the MBMS data transmission, should be able to discover possible MBMS transmission promptly in Idle mode or RRC connected mode.

From the UTRAN complexity point of view, a notification solution, which could serve both idle and RRC connected mode is clearly beneficial. On the UE complexity and especially power saving point of view, a notification solution, which does not require continue reception or does not require DRX cycle other than current used for UE dedicated paging would clearly be advantageous.

2   DISCUSSION

2.1   Pure PICH Based Notification

The solution proposed in this section allows for continues provision of MBMS service notifications over the air interface, thus it inherently solves the repetition problem of MBMS notification. Moreover no new physical or transport channel is required minimizing downlink transmission power consumption and code utilization.

The main idea is based on the use of the PICH channel and in particular of its 12 bits that are today *reserved for future use*. In the Figure 1, which illustrates one way to structure available bits, the 12 bits are divided in three fields.

Because the paging occasion is based on DRX cycle length and IMSI, the PICH frame, which UE shall listen to obtain paging indicator differs between UEs. Because the 6 bits is not enough to for complete notification solution, the first three bits defines a PICH frame cycle, which the joined UE shall read to obtain complete MBMS notification information. Thus the joined UE in Idle mode or RRC connected mode (CELL_PCH or URA_PCH) shall calculate the paging occasion based DRX

cycle length and its IMSI and listen not only one PICH frame but consecutive PICH as defined by first three bits to receive complete MBMS notification.

To have only one notification solution also for CELL_DCH and CELL_FACH, the UE, cable of receiving MBMS service simultaneously with other UE dedicated p-t-p services, should be able to listen also PICH based on its DRX cycle as CELL/URA_PCH state also in CELL_FACH and CELL_DCH state.

The first 3 bits are also used as indicator/description of the value/parameter given in the second field, which indicates for e.g. the identification of a current and forthcoming MBMS service. The Figure 1 also presents the other proposed identification/indications, which are required in MBMS notification. There is also proposed that the value 111 is used to have extension possibility of 6 bit indication/identification to 12 bits.

The Figure 2 presents the BITMAP and the bit usage of the BITMAP's 6 bits, is presented in Table 1, respectively. The third field is used to introduce 3 bit CRC for increasing the reliability of nine information bits.
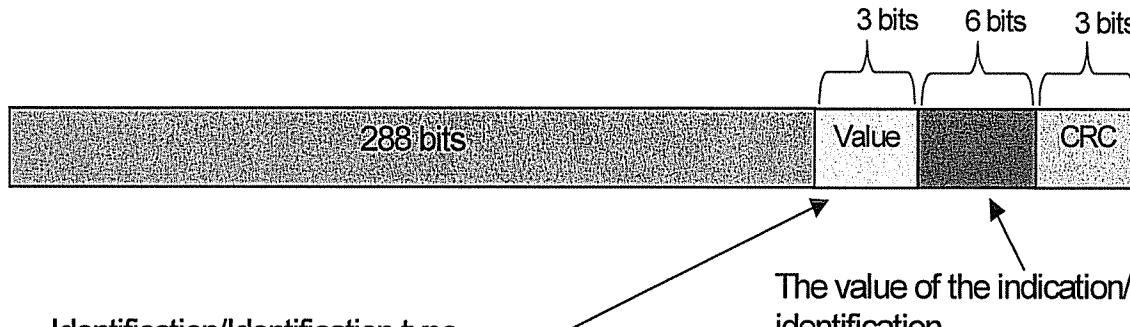

Value	Description
000	Next field defines the BITMAP
001	Next field identifies to current MBMS service
010	Next field identifies the next MBMS service
011	Next field identifies the SFN for Service announcement
100	Reserved
101	Reserved
110	Reserved
111	Previous frame was the first part of this frame

Figure 1: PICH frame structure (pure PICH solution)
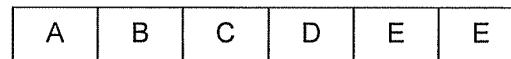
Figure 2: Bits in 6 bit BITMAP

Bit	Bit usage

A	Counting ongoing for forthcoming MBMS service 0 = NO, 1 = YES
B	Channel type selection of current MBMS service; 0 = p-t-m, 1 = p-t-p
C	Transmission is Broadcast or multicast; 0 = Broadcast, 1 = Multicast
D	Service announcement indicator 0 = No service announcement 1 = Yes service announcement
EE	p-t-m RB configuration set 00, 01, 10, 11 bit combination according SIB

Table 1: Bit usage in BITMAP

The last two bits (EE) of the BITMAP are proposed to indicate the valid MBMS p-t-m channel configuration from set of possible configurations signalled on SIB. The principles how MBMS p-t-m RB parameters are transmitted to UEs are discussed in more detail in the contribution *R2-030002*

2.2   Pros and Cons of the Proposed Pure PICH Approach

Advantages:
- No impacts to UEs supporting rel99/4/5
- No new channel is needed to support continues MBMS notifications.
- No new separate channel code allocation for notification channel is required
- Downlink transmission power is only slightly increased
- UEs, which are in RRC IDLE, CELL_PCH or URA_PCH, are in any case forced to wake up to listen PICH/SCCPCH in order to find out whether there is any paging message for them.
- Only one DRX cycle is required in UE.
- Only one notification method for UEs in IDLE and RRC connected, in case that MBMS capable UEs in CELL_DCH and CELL_FACH shall also listen PICH
- All UEs can find out what multicast services are currently available or will be transmitted in the near future.
- UEs are able to start receiving MBMS transmission even is already ongoing.
- No feedback is required from the UEs if not needed.
- Paging concept is left as in Rel'99

Disadvantages:
- Information bits on PICH are only protected by short CRC
- UE must listen more than one consecutive PICH frame
- UEs in CELL_DCH or CELL_FACH state must be able to listen PICH simultaneously with DPCH or SCCPCH respectively.

2.3   Notification Using PICH Together with Notification Channel

The solution proposed in this section is based on the use of the PICH channel and in particular of its 12 bits that are today *reserved for future use* as in previous solution but also include separate MBMS control channel (MCCH). If the notification is the only control information to be sent, the name of this channel can be the Notification Channel (NCCH), not the MCCH.

The main problem in usage of MCCH alone is the repetition interval so that each time, all joined UEs have to turn themselves to listen it. If the repetition interval is increased, UEs can stay longer period in DRX but the delay caused by notification to start MBMS service is also increased. From the UE point of view this introduces a new DRX cycle to be maintained together with Rel'99 paging.

In this solution these problems are avoided by using the PICH channel for scheduling purposes for the NCCH. The proposed frame structure is presented in Figure 3. As in solution one and in Rel'99 the UE wakes up to listen the PICH based on its IMSI but UE does have to listen less consecutive PICH frames compared to solution one. By listening, in two consecutive PICH frames, the UE obtains information of currently transmitted MBMS service and scheduling/timing information of forthcoming MBMS notification on MCCH.

Thus, the UE would have knowledge when to listen MCCH, enabling dynamic scheduling of notification without introducing new DRX cycles to UE. The dynamic scheduling of the notification is especially useful in case when no MBMS data is to be transmitted in near future in cell, because the UE does not have to listen MCCH at all.


Value	Description
00	Next field identifies to current MBMS service
01	Next field identifies scheduling information of the NCCH
10	Reserved
11	Reserved
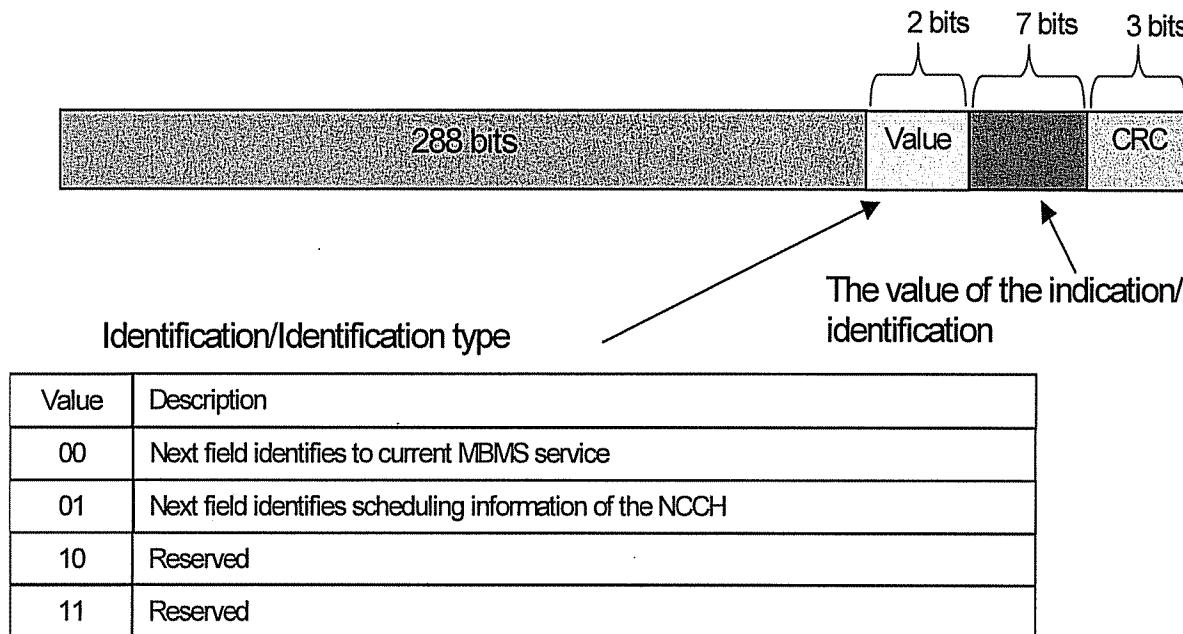
Figure 3 PICH frame structure (PICH with NCCH solution)

The principles how MBMS p-t-m RB parameters are transmitted to UEs are discussed in more detail in the contribution *R2-030002*

2.4 Pros and Cons of the Proposed Pure PICH Approach

Advantages:
- No impacts to UEs supporting rel99/4/5
- Downlink transmission power is not increased
- UEs, which are in RRC IDLE, CELL_PCH or URA_PCH, are in any case forced to wake up to listen PICH/SCCPCH in order to find out whether there is any paging message for them.
- Only one DRX cycle is required in UE.
- Only one notification method for UEs in IDLE and RRC connected, in case that MBMS capable UEs in CELL_DCH and CELL_FACH shall also listen PICH and MCCH
- All UEs can find out what multicast services are currently available or will be transmitted in the near future.
- Notification can be scheduled dynamically on MCCH
- No feedback is required from the UEs if not needed.
- Paging concept is left as in Rel'99

Disadvantages:
- New channel is needed to support continues MBMS notifications.
- UE must listen more than one consecutive PICH frame
- Downlink transmission powers are increased due to new channel
- UEs in CELL_DCH or CELL_FACH state must be able to listen PICH and MCCH simultaneously with DPCH or SCCPCH respectively.

3   CONCLUSSION

It is proposed that the notifications solution using PICH without and with MCCH is studied further.